

CASE REPORT

EXERCISE, MANUAL THERAPY AND POSTURAL RE-EDUCATION FOR UNCONTROLLED EAR TWITCHING AND RELATED IMPAIRMENTS AFTER WHIPLASH INJURY: A CASE REPORT

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ABSTRACT

Background and Purpose: Whiplash Associated Disorders and the interventions used to remediate them are well documented in physical therapy literature. However, specific interventions for spasms of the neck musculature that also involve constant ear twitching have yet to be addressed. The purpose of this case report is twofold. First, to describe comprehensive physical therapy management and outcomes for a subject with uncontrolled ear twitching and related musculoskeletal impairments, and second, to discuss the physical therapist's approach to evidence-based care when faced with a paucity of literature addressing physical therapy interventions for subjects with uncontrolled ear twitching.

Case Description: The subject was a 14-year-old female who sustained a right anterolateral whiplash injury when struck in the head by a volleyball seven months prior to physical therapy. Beginning five months after that injury, she experienced uncontrolled and constant superior/inferior movement of her right ear (hereafter described in this report as a twitch) in addition to facial and cervical pain from her initial injury. She was unable to participate in high school athletics due to her pain. A multimodal treatment approach including exercise, manual therapy, and postural reeducation was utilized during the subject's episode of care.

Outcomes: After eight treatment sessions, the subjects's cervical range of motion and upper extremity strength improved. The reported frequency of ear twitching decreased, as did reports of neck and shoulder pain. In addition, her Neck Disability Index improved from a score of 22, indicating moderate disability, to 9, indicating mild disability and she was able to return to sport activity.

Discussion: With limited research to direct intervention, clinical reasoning was utilized to formulate an effective therapeutic intervention. A combination of manual therapy, exercise, and postural reeducation intervention was effective for this subject and could assist in guiding interventions for similarly unique clinical presentations in the future. Further research is needed to examine the etiology of ear twitching caused by muscle spasm and to develop additional evidence-based interventions for Whiplash Associated Disorders.

Level of Evidence: Level 4

Key words: Ear twitching, manual therapy, postural reeducation, sternocleidomastoid muscle spasm, whiplash associated disorders

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BACKGROUND AND PURPOSE

Whiplash Associated Disorders (WAD) are extremely common in North America, and have a significant impact on individuals in terms of physical and psychosocial dysfunction, including long-term physical impairment, pain, and mental health conditions such as anxiety, depression, and post-traumatic stress disorder.¹ Over half of patients with WAD report pain and physical dysfunction 12 months or longer following their initial injury.¹ Further, WAD takes a large economic toll, resulting in over 200 billion dollars in health care expenditures yearly.² While neck pain is the hallmark symptom of WAD, other symptoms have been reported in the literature, including headache, vestibular and visual changes, paresthesia, upper extremity pain, widespread stiffness and non-specific muscle spasm.^{1,3,4}

Whiplash injuries are often discussed in the context of motor vehicle collisions, but can occur as a result of any impact characterized by a rapid acceleration followed by a rapid deceleration of the neck and head.⁵ Research into non-conventional whiplash impacts note that different directions of impact cause unique muscle responses and ultimately, unique cervical dysfunctions.⁶ Whiplash-associated cervical muscle spasms can be identified by the direction of impact. In rear-end impacts, the main impact is on the sternocleidomastoid (SCM) muscle. In frontal impacts, the upper trapezius muscle is commonly involved, and in lateral impacts, the splenius capitis is most affected.⁷ Kumar et. al.⁶ found that during injuries involving anterolateral impacts, the SCM, splenius capitis and upper trapezius electromyography (EMG) peak amplitudes increase steadily with increased magnitude of impact. In addition, head and neck acceleration and the resultant muscle response significantly increases when a whiplash impact is unanticipated.⁶

Physical therapy management for chronic WAD (longer than 12 weeks post-injury) may include exercise programs, manual joint manipulation, and biofeedback training to relieve pain and improve functional ability.⁵ In light of these findings for whiplash impairments, manual therapy and exercise were hypothesized to produce similar outcomes in a subject who experienced an unanticipated, anterolaterally directed, whiplash injury with resultant long-term

pain and muscle spasms in her neck musculature. These spasms were also uniquely associated with an uncontrolled, continuous, superior-inferior translation of the right ear, referred to in this case report as 'ear twitching'. At the time of the subject's initial visit, several authors had addressed the effects of whiplash injuries on neck impairments.^{1,3,4,8} However, none of the literature discussed the relationship between whiplash injury and ear twitching, nor physical therapy intervention for ear or SCM spasms specifically. Thus, this case report helps to fill a current gap by exploring the effectiveness of physical therapy intervention for ear twitching and associated neck pain and spasms. The purpose of this case report is twofold. First, to describe comprehensive physical therapy management and outcomes for a subject with uncontrolled ear twitching and related musculoskeletal impairments, and second, to discuss the physical therapist's approach to evidence-based care when faced with a paucity of literature addressing physical therapy interventions for subjects with uncontrolled ear twitching.

CASE DESCRIPTION: SUBJECT HISTORY AND SYSTEMS REVIEW

A 14-year-old female, in her usual state of excellent health, was hit with a volleyball on the right anterolateral aspect of her head seven months prior to the initial physical therapy visit. Initial symptoms included right facial, bilateral cervical, and bilateral upper back pain. Five months after the initial injury, and two months prior to the initial therapy visit, the subject began her high-school softball season. During softball, the subject began experiencing frequent headaches and constant right "ear twitching", symptoms which worsened over the subsequent two months leading up to the physical therapy evaluation. The subject's chief complaints at time of initial evaluation included impaired ability to perform activities of daily living such as reading, texting and carrying a laundry basket. Of greatest importance to the subject, was her inability to participate with her peers in competitive sports due to the pain. The subject had no significant past medical history or comorbidities and was a student-athlete at a local high school. She was receiving no other intervention for her impairments at time of evaluation. The subject's desired goals were to eliminate ear twitching

and return to prior participation in high school athletics.

CLINICAL IMPRESSION #1

It was evident from the subject's description that the primary problem was chronic neck and shoulder pain with subacute ear twitching that limited the subject's ability to participate in high school sports and other daily activities. It was hypothesized that the neck and shoulder pain were due to a combination of poor posture and long-term sequelae from a whiplash-type injury that had occurred seven months prior to the physical therapy evaluation. The most unique portion of the subject's presentation was the presence of an uncontrolled ear twitch. Initially, it was unclear whether the ear twitching was due to a neuromuscular injury, musculoskeletal injury or combination of the two. A systems review revealed that all vital signs were normal. Additional examination was warranted to determine the precise cause of the ear twitching. Prior brain imaging, taken at the time of injury, was to be reviewed by the referring physician to rule out neurologic injury. A detailed neurological screen was also planned for the physical therapy examination to rule out any possible central nervous system causes. Additionally, a thorough strength, range of motion and segmental mobility evaluation for both the cervical spine and upper extremity was planned. Finally, the Neck Disability Index (NDI) was utilized to provide an objective measure of subject reported functional limitations. The subject's unusual symptoms and clinical presentation provided a unique opportunity to explore interventions for symptoms without a concrete diagnosis and therefore made her a good candidate for a case report. The authors' institutional review board granted ethical approval for this case report. The subject's mother provided informed consent and permission for both creation of a case report and submission for publication, and the subject provided verbal assent to participate in the case report.

EXAMINATION

Initial medical evaluation by the subject's primary physician showed normal brain computerized tomography (CT) and magnetic resonance imaging (MRI) scans. The subject was then referred to

physical therapy with a diagnosis of "cervicalgia", the origin of which was determined to be musculoskeletal in nature.

Upon initial observation, the subject's right ear was repetitively moving superiorly and inferiorly at a rapid rate. Upon closer visual inspection, a spasm of the right proximal SCM muscle was witnessed in conjunction with the right ear movement. In sitting, the subject assumed a forward head posture with protracted scapulae. Upon palpation, bilateral scalene, SCM, and upper trapezius, and right-sided temporalis muscles were tender to palpation with trigger points present throughout each muscle. Palpation of the right side elicited more discomfort than the left. Segmental mobility testing of the cervical and upper thoracic spine revealed hypomobility and pain reproduction, especially with right unilateral posterior to anterior (PA) mobilization at C2 and central PA mobilization at C6-T1.

The subject was screened for central nervous system dysfunction using myotome,^{9,10} dermatome (light touch and sharp/dull),¹¹ and reflex testing in order to rule out neurologic contributions to her symptoms.¹² No resting nystagmus, visual field cuts, or light sensitivity was observed. Based on these results, no other specific neurologic tests were performed. The Numeric Pain Rating Scale^{13,14} was used to assess her self-reported pain. This scale was used because it has been documented in the literature as providing fair to moderate reliability in patients with mechanical neck pain as well as adequate validity for the same population.¹⁵ The subject reported her pain at a 7/10 at worst and 5/10 at the time of the initial visit.

Manual Muscle Testing (MMT) was performed in standard positions as described by Reese¹⁶ on major upper extremity muscle groups in order to assess the relationship between strength impairments and clinical presentation. Grading was assigned as described by Kendall et al.¹⁷ Manual muscle testing has been found to have good reliability and validity for neuromusculoskeletal dysfunctions.¹⁸ Reese has also summarized the literature of MMT reliability and found "good intra-rater reliability for MMT".¹⁶ However, grades of 4/5 and higher have been found to lack sensitivity and precision which

causes a ceiling effect.¹⁹ Because of this, a hand held dynamometer was utilized to measure grip strength in order to provide another measure of the subject's strength for comparison. Measurements took place in the standard position,²⁰ as described by Horowitz et al. For healthy adults, dynamometric grip strength measurements were found to have excellent intra-rater and inter-rater reliability,²¹ as well as excellent criterion validity.²¹ The subject's grip strength results supplemented the MMT results in order to assess strength impairments and their association with the subject's functional limitations. The results of the MMT and dynamometry measurements are listed in Table 1.

The subject had normal upper extremity range of motion (ROM) in all joints as assessed in standard positions as described by Norkin & White.²² Her cervical ROM was impaired, limited primarily by mus-

cular tightness. Goniometry has been found to be a valid test to measure range of motion,²³ as well as possessing high intra-rater reliability for both shoulder²⁴ and neck²⁵ measurements. The results of the cervical ROM measurements are listed in Table 2.

In addition, the NDI²⁶ was utilized to assess the subject's limitations in functional activities. The NDI is a self-report questionnaire that determines to what extent subjects' neck pain affects their daily life. It has been found to have adequate test-retest reliability for mechanical neck pain²⁶ and excellent construct validity for whiplash-associated disorders.²⁷ The questionnaire has 10 questions, which are rated using a Likert scale of one to five, one being minimal impact on daily activity and five being significant impact on daily activity. A raw score of 5-14 indicates mild disability, 15-24 indicates moderate disability, 25-34 indicates severe disability, and above

Table 1. *Manual Muscle Testing and Dynamometry.*

	Initial		Discharge	
Muscle	Left	Right	Left	Right
Deltoid/Biceps	5/5	5/5	5/5	5/5
Wrist Extensors	5/5	5/5	5/5	5/5
Wrist Flexors	5/5	5/5	5/5	5/5
Triceps	5/5	5/5	5/5	5/5
Thumb Extensors	4+/5	4+/5	5/5	5/5
Interossei	4+/5	4+/5	5/5	5/5
Grip Strength	38lbs	36lbs	Unable to retest*	
*Unable to retest dynamometry at discharge due to device malfunction.				

Table 2. *Cervical Range of Motion.*

Motion	Initial	End-Feel	Discharge	End-Feel
Flexion	50°	Soft Tissue	50°	Soft Tissue
Extension	50°	Soft Tissue	50°	Soft Tissue
Left Side bending	34°	Painful	34°	Soft Tissue
Right Side bending	33°	Painful	40°	Soft Tissue
Left Rotation	64°	Soft Tissue	75°	Soft Tissue
Right Rotation	60°	Soft Tissue	70°	Soft Tissue

34 indicates complete disability. The subject's raw score of 22 indicated a moderate disability in her daily life due to neck pain.

CLINICAL IMPRESSION #2

Following the examination, the data obtained confirmed the initial impression that the subject's dysfunction was musculoskeletal in nature. Therefore, it was determined that the appropriate plan of action was to initiate physical therapy intervention to address her primary impairments of decreased range of motion, decreased postural awareness, decreased strength and pain. Since no evidence was available at the time to direct treatment for the ear twitch, interventions were directed toward the specific impairments identified during the examination in order to improve her ability to perform functional tasks and return to prior sport activity. This subject continued to be a prime candidate for a case report due to the musculoskeletal nature of her impairments and the limited research available to guide specific intervention for her unique pathological presentation. The subject was scheduled to receive physical therapy intervention twice per week for four weeks, at which point a reassessment would be performed.

INTERVENTION

The physical therapy intervention plan for this subject was developed by the primary physical therapist utilizing an evidence-based approach. A literature review was conducted using both medical and allied health databases including PubMed, CINAHL, Scopus, and the University of Illinois Chicago library's literature search engine. Key words used in the search included: "ear twitching", "ear wiggling", "ear spasm", "neck muscle spasm", "temporalis spasm", "rehabilitation", and "physical therapy". The literature found during that search was minimal and largely irrelevant. The search was then broadened to include: "whiplash" "anterolateral impacts" "chronic neck pain" and "sternocleidomastoid spasm". While these results did not lead to significantly valuable descriptions of physical therapy interventions for this unique case, they enabled the physical therapist to research similar mechanisms of injury to understand the physiologic repercussions of an anterolateral whiplash injury and develop interventions

to address these impairments. Thus, the physical therapist blended the available literature, input from other experienced physical therapists, clinical practice guidelines for neck pain,²⁸ and the therapist's own clinical reasoning to develop the specific interventions utilized to address the subject's impairments and functional limitations. Rehabilitation goals were focused on strengthening postural muscles and mobilizing cervical joints and musculature that were limiting movement and causing pain.

Therapeutic exercise is widely used as part of a comprehensive treatment approach to physical therapy management of chronic neck pain. According Pangarkar et. al.,²⁹ p. 510 "Postural evaluation, support and therapeutic exercises are considered to be a foundation of treatment." Postural habits are believed to contribute to the development of cervical muscle imbalances and subsequent neck pain. Postural awareness and exercises based on stretching, strengthening and range of motion are proposed to help address these deficits. One Cochrane review by Kay et. al.³⁰ found moderate evidence supporting focused stretching and strengthening at the cervical, shoulder and thoracic regions to improve chronic mechanical neck pain. In addition, retraining the deep cervical flexor musculature through strength-endurance and cranio-cervical flexion exercises has been shown to decrease neck pain symptoms for subjects suffering from chronic neck pain and may improve the capacity of the cervical spine to sustain an upright posture.³¹

In addition to therapeutic exercise, research has shown that a multimodal strategy of therapeutic intervention that utilizes exercise and mobilization/manipulation techniques may result in more significant improvements in pain and function, demonstrating a 28% to 70% treatment advantage over a control subject utilizing exercise alone.³² This information led to the development of a multimodal treatment plan, which included both manual therapy and exercise.

A combination of therapeutic exercise, manual therapy, and a home exercise program (HEP) were designed to address the subject's impairments. Table 3 describes the specific therapeutic interventions performed each session. These exercises were

Table 3. *Intervention Details.*

Visit Number	Education	Manual Therapy	Exercise
1	-Muscular anatomy of neck, proper posture during school and sport.	-Soft tissue mobilization: right masseter, right temporalis, bilateral scalene, levator scapulae, upper trapezius, suboccipital, and sternocleidomastoid muscles. -Cervical distraction of cranial base grade II.	-Pectoralis stretch in doorway (20sec x 2). -External Rotation with scapular retraction using red Theraband (10x). -Supine cervical nodding on towel roll (5x).
2	-Return to sport timeframe. -HEP: Deep cervical flexion nodding and horizontal abduction with scapular retraction using Theraband.	-Soft tissue mobilization as performed in prior treatment. -Right first rib mobilization grade II-III. -Cervical distraction of cranial base grade III. -PA mobilization C2 to T4 Grade II-III.	-Supine deep cervical flexion nodding (15x). -Supine deep cervical flexion nod hold (15sec x5).
3		- Soft tissue mobilization as performed in prior treatments. -Cervical distraction of cranial base grade III. -Manual upper trapezius stretch bilaterally. -AP mobilization of the mastoid process grade II-III.	-Supine deep cervical flexion nodding (15x). -Supine deep cervical flexion nod hold (15sec x5). -Horizontal abduction with scapular retraction using red Theraband (10x).
4	HEP: Red Theraband rows and pull downs using household door (10x each). Cues required to relax upper trapezius muscle.	- Soft tissue mobilization as performed in prior treatments. -Cervical distraction of cranial base grade III. -Manual upper trapezius stretch bilaterally.	-Horizontal abduction with scapular retraction using green Theraband (10x). -Pectoralis stretch in doorway (20sec x2). -External rotation with scapular retraction using green Theraband (10x). -Rows and pull downs using wall mounted pulley system (9lbs, 15x each).
5		- Soft tissue mobilization as performed in prior treatments. -Right first rib mobilization grade III. -Cervical distraction of cranial base grade III.	-Supine deep cervical flexion nodding (15x). -Supine deep cervical flexion nod hold (20sec x5). -Horizontal abduction with scapular retraction using red Theraband (20x). -Pectoralis stretch in doorway (20sec x4). -External Rotation with scapular retraction using red Theraband (20x).

Table 3. *Intervention Details (continued).*

6		<ul style="list-style-type: none">- Soft tissue mobilization as performed in prior treatments.-Cervical distraction of cranial base grade III.-PA mobilization C2-T4 Grade II-III.-Manual upper trapezius stretch bilaterally.	<ul style="list-style-type: none">-Pectoralis stretch in doorway (20sec x4).-Rows and lat pull downs using wall mounted pulley system (9lbs, 20x each).-Bilateral external rotation throw onto trampoline using 2lb medicine ball (20x).-Wall pushups (15x2).-Clockwise/Counterclockwise circles on wall with ball with serratus anterior activation (30 sec each direction).-Pillowcase slide up/down wall with active abduction against pillowcase (10x).
7		<ul style="list-style-type: none">- Soft tissue mobilization as performed in prior treatments.-Cervical distraction of cranial base grade III.-AP mobilization of mastoid process Grade III.	<ul style="list-style-type: none">-Supine deep cervical flexion nodding (15x).-Supine deep cervical flexion nod hold (20sec x5).-Wall pushups (20x2). Cues required for scapular control.-Clockwise/Counterclockwise circles on wall with ball with serratus anterior activation (2lb medicine ball, 30 sec each direction).-Pillowcase slide up/down wall with active abduction against pillowcase (10x).-Modified (on knees) pushup on Bosu (15x).-Overhead throw against trampoline using 2lb medicine ball (20x).-Volleyball set against wall using deflated basketball (20x).
8	Updated and reviewed HEP.	<ul style="list-style-type: none">- Soft tissue mobilization as performed in prior treatments.-Cervical distraction of cranial base grade III.-Manual upper trapezius stretching.	<ul style="list-style-type: none">-Horizontal abduction with scapular retraction using red Theraband (20x).-External rotation with scapular retraction using red Theraband (20x).-Bilateral pectoralis stretch in doorway (20 sec x2).-Rows and lat pull downs using green Theraband in household door. (15x each)-External rotation and overhead throws against trampoline with 2lb medicine ball (20x each).-Wall pushups (20x2).-Clockwise/counterclockwise circles on wall with 2lb medicine ball and serratus anterior activation (20x each direction).-Volleyball sets against wall with large yoga ball (20x).

progressed throughout the duration of treatment to include more complex, challenging and sport-specific exercises. Exercises were progressed when the subject was able to perform exercises without cueing for proper form and reported no fatigue with the exercise. Progression occurred by increasing intensity and complexity of exercises, such as advancing from a red to a green resistance band, and incorporating compliant surfaces such as a BOSU® and therapy ball to encourage shoulder and scapular stabilization in addition to strengthening. At the time of intervention, the subject was not receiving any other form of outside treatment for her impairments.

OUTCOME

After eight physical therapy sessions, the subject met all goals and reported significant improvement in neck pain and ear twitching. Resting neck pain improved from 5/10 at initial evaluation to 2/10 at discharge. She was also able to return to play for her competitive softball team. While the subject's primary complaint of ear twitching was not completely resolved by discharge, the twitch occurred approximately six times per day as compared to the constant movement experienced at initial visit. The subject reported that in addition to decreased frequency, that she was "somewhat able to control" the ear movement now through active postural repositioning.

The subject's second major complaint of shoulder and neck pain at rest was completely resolved after eight sessions. Her only report of pain was after a lengthy double-header softball game prior to discharge. Her NDI score improved from a score of 22 indicating moderate disability at initial examination to a score of 9 indicating mild disability upon discharge. As the MCID for the Neck Disability Index is 7.5 points for mechanical neck pain,²⁶ this change demonstrates clinically significant results. Specific functional improvements included an improved ability to text, read, and carry laundry without discomfort or onset of ear twitching movement.

The strength and range of motion gains made by the subject are shown in Table 1 and Table 2 above. These gains may have contributed to her decreased pain and increased ability to perform functional activities. By her last session, the subject was able to self-correct her posture without cueing. While the

subject still experienced some pain and ear twitching, insurance limitations hindered the continuation of physical therapy intervention. At discharge, the subject planned to maintain compliance with her home exercise program to continue to make therapeutic gains and ultimately felt enough improvement in her symptoms to attend volleyball camp three months after discharge.

DISCUSSION

This case report presents the course of physical therapy intervention aimed at restoring functional mobility and decreasing the presence of ear twitching in a 14-year-old high school athlete. At the end of eight treatment sessions, the subject achieved all stated therapy goals and returned to competitive sport participation.

Researchers have discussed the effects of unconventional whiplash injuries and the subsequently recommended physical therapy interventions, but the literature has failed thus far to report the onset of ear twitching after chronic WAD. In turn, research directing the physical therapy intervention of such a presentation is equally limited. This case highlights the challenge of developing an evidence-based treatment plan for a clinical presentation that is not documented in the literature, as well as provides promising outcomes for clinicians to consider when planning interventions for similar cases.

Based on information from whiplash literature noting SCM muscle involvement in anterolateral impact whiplash injuries, as well as the subject's clinical presentation of right SCM spasm and temporalis tenderness, it was hypothesized that the subject's constant ear twitching was a result of a SCM spasm, which pulled the ear inferiorly on a resisting temporalis muscle. While a physical therapy diagnosis was not explicitly identified at the time of evaluation, the therapist recognized the unique mechanism of injury and relationship between the SCM muscle spasm and the ear twitch, which then led to the development of a plan of care. Although a formal diagnosis was not made, this working diagnosis guided the interventions, utilizing treatment strategies that were consistent with the available associated research to address the impairments of this unique pathological presentation.

This case report has several limitations that restrict its ability to be applied to a larger population. The first is the lack of a concrete diagnosis to guide intervention, which has been addressed above. Second, the time frame available for this intervention was limited. Due to insurance limitations, only eight visits were allocated to treat chronic neck pain and subacute ear twitching. While progress was seen in eight visits, a longer duration of treatment may have provided greater clarity as to whether the intervention was successful long term or whether the subject's progress would have plateaued with the current intervention. Third, long term results are unknown. Attempts to reach the subject following the episode of care were unsuccessful, however, as of this case report submission, thirty-three months following intervention, the subject did not return to the clinic to seek any additional care for associated symptoms. It is unknown whether the ear twitching ceased entirely or returned after the subject resumed sport competition. Finally, it is unclear whether one intervention provided more effect than another since a multimodal approach was utilized. Despite these limitations, while it is impossible in a single case to demonstrate a direct relationship between the interventions provided and the subject's outcome, a positive outcome has been identified in this report.

In this case report, the use of exercise, manual therapy, and postural reeducation resulted in the reduction of pain and frequency of ear twitching, as well as a restoration of functional mobility. Research discussing therapeutic intervention for whiplash-associated dysfunction highlights emerging evidence that a combination of therapeutic exercise and manual therapy are beneficial in subjects who experienced chronic mechanical neck pain as a result of whiplash injury.^{5,29,31,32} Because a lack of a formal diagnosis makes directing an intervention especially challenging, future research should focus on identifying a concrete diagnosis for constant uncontrolled ear twitching secondary to cervical muscle spasms in order to guide physical therapy intervention specifically for this clinical presentation.

CONCLUSION

This case report appears to be the first to describe a detailed course of rehabilitation for a subject with

a continuous ear twitch and neck pain after an anterolateral whiplash injury. This case report also details treatment planning for a patient whose clinical presentation cannot be found in the literature. Over eight treatment sessions, the subject made significant improvements in cervical range of motion, neck pain, and ear twitch presence. After treatment, she was able to return to all prior activities including competitive softball and volleyball play.

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